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14.0.A Daily Outline

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Chem 444A, Fire and Ice, Day 13 March 10, CFB Daily OUTLINE

Purpose:

- Visualization of heat transfer by conduction
- Further development of the concept of heat, linking to energy and molecular motion
- Conceptual challenges and extensions

Board

Find your group (same roles as last class)

(Just put nametags out without saying make them. See if they do.)

Get your eye protection – for sure today

Once your entire table is present, get started.

See folder for instructions.

DON'T FORGET TO CLAP

Materials

Name tags (4 per table)

Premade name cards (set on tables) – shuffle the table locations B D E

A C

White board markers

Returns

Distributions

- Group organization instructions
- Experiment Instructions

Starting Comments 1 minute max

- Select someone to clap
- Get started – At some point, when I see all the data are posted. I might stop you for a brief conference to point out a few things
- Task 2 – let me know when you get to question 8.
- Desirable to get to started with Task 3 no later than 4:15.

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Keep the same role structure today as you had last class (manager, recorder, spokesperson, encourager – if you are in 5-person group, let the encourager be the person who did not have a role last time)

Task 1:

Complete the graphs of your data, and post it up on the wall. If you have completed that, proceed to Task 2. Please get this done as efficiently as you can.

In review, it seems that all experimental conditions have been tested, so we are ready for a conference after the graphs are posted.

Task 2:

Once you have prepared your graph, start considering these questions. Use a new recorder report form.

1) Look at the shape of the graphs from the second set of experiments. Describe the shape of the graphs so that someone who can't see the graphs can image what they look like (and could reproduce the shape).

2) The shape you see illustrates an important principle of all matter. See if you can state it by starting a sentence with "When two materials at different temperatures are ……" Ask CB to listen to your statement, and he'll tell you the formal name (s).

3) Is the hypothesis of hot-stays-hot-and-cold-stays-cold supported by the data?

4) Are the results of this second set of experiments consistent with the results of the direct mixing experiments? Cite specific data.

5) Does the hot water give caloric corpuscles to the cold water?
Does the cold water give frigorific corpuscles to the hot water?
Is there a better way to explain the process?

6) Do our experiments support the notion of conservation of energy? How so?

Christopher F. Bauer, Principal Investigator.
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7) Assuming you like the energy idea, how can you use the graph to tell you something about the quantities of energy involved?

8) Try to write a little mathematical equation that expresses this energy idea in terms of the information on the graph. [It may be easier to figure this out by using the direct mixing experimental data. And to look at the equal-volume condition first. Then consider the non-equal volume condition.] Your equation should make sense in terms of your model that you described in #5.

9) We may have a general conference at this point, or we may proceed to more experiments.

Task 3: Extensions of the ideas

Choose one of the research questions below.
I will also entertain alternative suggestions from your group.

Design an experiment that will help you investigate the question. I will have materials available that may spark your thinking. Clear your intended procedure with an instructor. Gather the data, review, perform additional confirmatory experiments if necessary, and assemble information for presentation (e.g. graph of data).

Research Questions

1) Can the movement of heat be controlled?

2) Do cold things have heat?

3) Do different substances have the same ability to provide heat?

4) Develop proof that latent heat of phase change actually involves heat transfer.

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Materials available to view:

Small glass, Styrofoam, plastic, aluminum containers

- These are for "control of heat movement" experiments. Glass and Styrofoam will be most interesting.
- Nested blue plastic cups will also be interesting – an example of air insulation

Thermometer stuck in a bulb of water (like phase change experiments):

- Put into powdered dry ice until temperature is falling below freezing point
- Use mug containing enough water to submerge the bulb of the pipet (to prevent residual ice from staying around)
- Do it on a stir plate -- keeps temp of water even STIR PLATE AND STIR BAR

There is 40 mL of methanol in the freezer in an aluminum can. Seal with Parafilm? NEED SEVERAL

Blocks of metal and sand. PUT SAND IN A BEAKER

Microwave oven for making hot water (500 mL for 1 min → about 60C)

Freezer set to about – 15 C

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